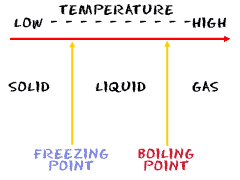
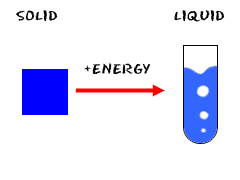
**Changing States of Matter**

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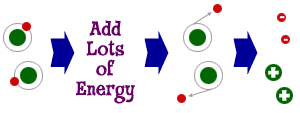
All matter can move from one state to another. It may require very low temperatures or very high pressures, but it can be done. Phase changes happen when certain points are reached. Sometimes a liquid wants to become a solid. Scientists use something called a freezing point to measure when that liquid turns into a solid. There are physical effects that can change the freezing point. Pressure is one of those effects. When the pressure surrounding a substance goes up, the freezing point also goes up. That means it's easier to freeze the substance at higher pressures. When it gets colder, most solids shrink in size. There are a few which expand but most shrink.



Now you're a solid. You're a cube of ice sitting on a counter. You dream of becoming liquid water. You need some energy. Atoms in a liquid have more energy than the atoms in a solid. The easiest energy around is probably heat. There is a magic temperature for every substance called the melting point. When a solid reaches the temperature of its melting point it can become a liquid. For water the temperature has to be a little over zero degrees Celsius. If you were salt, sugar, or wood your melting point would be higher than water.

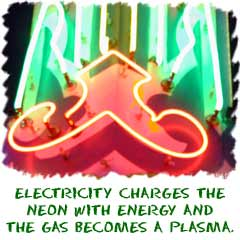
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The reverse is true if you are a gas. You need to lose some energy from your very excited gas atoms. The easy answer is to lower the surrounding temperature. When the temperature drops, energy will be sucked out of your gas atoms. When you reach the temperature of the condensation point, you become a liquid. If you were the steam of a boiling pot of water and you hit the wall, the wall would be so cool that you would quickly become a liquid.

Finally, you're a gas. You say, "Hmmmm. I'd like to become a plasma. They are too cool!" You're already halfway there being a gas. You still need to tear off a bunch of electrons from your atoms. Eventually you'll have bunches of positively and negatively charged particles in almost equal concentrations. When the ions are in equal amounts, the charge of the entire plasma is close to neutral. (A whole bunch of positive particles will cancel out the charge of an equal bunch of negatively charged particles.) Plasma can be made from a gas if a lot of energy is pushed inside. All of this extra energy makes the neutral atoms break apart into positively and negatively charged ions and free electrons. They wind up in a big gaseous ball.

**Chemical vs. Physical Changes**

Section 1



It is important to understand the difference between chemical and physical changes. The two types are based on studying chemical reactions and states of matter. We admit that some changes are obvious, but there are some basic ideas you can use. Physical changes are about energy and states of matter. Chemical changes happen on a molecular level.

When you step on a can and crush it, you have forced a physical change. The shape of the object has changed. It wasn't a change in the state of matter, but something changed. When you melt an ice cube you have also forced a physical change (adding energy). That example caused a change in the state of matter. You can cause physical changes with forces like motion, temperature, and pressure.

**Section 2**

Chemical changes happen on a much smaller scale. While some experiments show obvious chemical changes such as a color change, most chemical changes happen between molecules and are unseen. When iron (Fe) rusts you can see it happen over a long period of time. The actual molecules have changed their structure (the iron oxidized). Melting a sugar cube is a physical change because the substance is still sugar. Burning a sugar cube is a chemical change. The energy of the fire has broken down the chemical bonds.

Some changes are extremely small. Chemical changes can happen over a series of steps, and the result might have the same number of atoms but have a different structure. The sugars glucose, galactose, and fructose all have six carbon atoms, twelve hydrogen atoms, and six oxygen atoms. Even though they are made of the same atoms, they have very different shapes and are called structural isomers. They each have different chemical reactions because of their molecular structure.

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